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METHOD AND DEVICE FOR PERFUMING LAUNDRY

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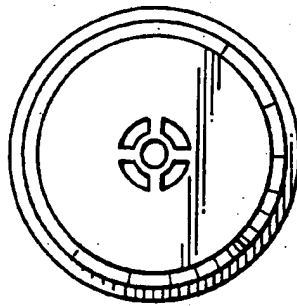Dansom Lane
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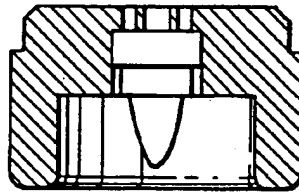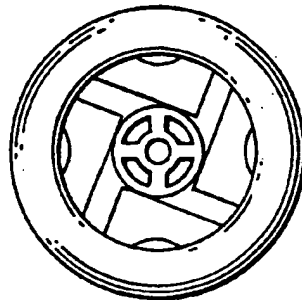United Kingdom

Fig.1a.

Fig.1b.

Fig.1c.

and targeting insects. This charge level is considerably higher than the charge level which is achieved when spraying conventional liquid formulations from conventional aerosol spray device where charge levels of the order of +/- 1 x 10^{-5} to +/- 1 x 10^{-8} C/kg are obtained.

In the formulations of the present invention it is the combination of components (b) and (d) of the emulsion which improves the electron transfer through the emulsion with the charge being transferred from droplet to droplet through the emulsion at the interface between the disperse phase and the continuous phase.

The various components (a) to (e) of the compositions of the present invention are discussed in turn below:

Propellants

One or more propellants are used in the composition of the invention in a total amount of from 2 to 80% w/w. Amongst the propellants that may be used are hydrocarbons and compressed gas, of which hydrocarbons are preferred.

Hydrocarbon propellants which may be used are acetylene, methane, ethane, ethylene, propane, n-butane, n-butene, isobutane, isobutene, pentane, pentene, isopentane and isopentene. Mixtures of these propellants may also be used. Commercially available propellants typically contain a number of hydrocarbon gases. For example, an odorised commercial butane, contains predominantly n-butane and some iso-butane together with small amounts of propane, propene, pentane and butene.

Preferred hydrocarbon propellants include propane, n-butane, isobutane, pentane and isopentane,

whilst the most preferred are propane, iso-butane and n-butane.

Particularly preferred hydrocarbon propellants are mixtures of propane, n-butane and iso-butane.

Whilst broadly the concentration of hydrocarbon propellant will be from 2 to 80% w/w, generally the concentration will be from 10 to 60% w/w, preferably 25 to 60% w/w and most preferably about 40% w/w.

When compressed gases are used as a propellant these will generally be carbon dioxide, nitrogen or air. Usually, they will be used at a concentration of 2 to 20% w/w, preferably about 5% w/w.

Non-ionic Surfactants

Non-ionic surfactants for use in the present invention include mono, di and tri sorbitan esters, polyoxyethylene mono, di and tri sorbitan esters; mono and polyglyceryl esters; alkoxylated alcohols; alkoxylated amines; alkoxylated acids; amine oxides; ethoxylated/proproxylated block copolymers; alkoxylated alkanolamides; and alkoxylated alkyl phenols.

Particularly preferred are those surfactants which contain at least one alkyl, allyl or substituted phenyl group containing at least one C_6 to C_{22} carbon chain. Examples are esters with C_{10}-C_{22} fatty acids, preferably C_{12}-C_{18} fatty acids, particularly polyglycerol oleate and ethoxylated fatty alcohols, such as oleyl alcohol ethoxylated with two moles of ethylene oxide. Further examples are the polyethylene glycol oleates, such as PEG-4 oleate, PEG-8 oleate and PEG-12 oleate.

In some instances, the non-ionic surfactant may itself be combined with component (d). For example, when the non-ionic surfactant is polyglycerol oleate,

the surfactant may contain small quantities of sodium or potassium oleates as impurities as a by-product of manufacture. For example is an amount of from 0.01 to 1% by weight. Greater quantities of such ionic compounds are generally not desirable and may result in the compositions not fulfilling the conductivity requirements of the compositions of the invention.

The concentration of the non-ionic surfactant is from 0.01 to 10% w/w, preferably 0.01 to 1% w/w.

Polar, ionic, aromatic or conjugated compounds

The polar or ionic or aromatic or conjugated compound which is included as component (d) in the compositions of the present invention is preferably a compound which is attracted to the interface between the disperse phase and the continuous phase and may be selected from:

a) alkali metal salts, alkaline earth metal salts, ammonium salts, amine salts or amino alcohol salts of one or more of the following compounds: alkyl sulphates, alkyl ether sulphates, alkylamidoether sulphates, alkylarylpolyether sulphates, monoglyceride sulphates, polyglyceride sulphates, alkyl sulphonates, alkylamine sulphonates, alkyl-aryl sulphonates, olefin sulphonates, paraffin sulphonates, alkyl sulpho-succinates, alkylether sulphosuccinates, alkylamide sulphosuccinates, alkyl sulphocinnamates, alkyl sulphoacetates, alkyl phosphates, alkylether phosphates, acyl sarcosinates, acyl isothionates and N-acyl taurates;

b) alkyl amidopropylbetaines, alkylamido-betaines, alkylamidosulphobetaines, alkylbetaines, aminimides, quaternary ammonium compounds and quaternary phosphonium compounds;

c)   carboxylic acids, carboxylic acid salts, esters, ketones, aldehydes, amides or amines of carboxylic acids containing from 6 to 30 carbon atoms;

d)   diethyl orthophthalate, methylphenylcarbinyl acetate, α-methyl ionone, 4-hydroxy 3-methoxy-benzaldehyde, phenylethyl alcohol, dipropylene glycol, styryl acetate, n-butyl benzoate, isopropyl 4-hydroxybenzoate, isobutyl acetophenone, isopropyl acetophenone, nicotinic acid, benzoic acid, 2-naphthol, neopentyl benzene, naphthalene, toluene, fullerene, tannic acid, t-butylacetophenone,   --isopropylcinnamte, resorcinol, 4-methoxycinnam-aldehyde, arbutin, 4-acetoxy-3-methoxycinnamaldehyde, 4-isopropylphenol, trans-stilbene, esculetin, p-chloro-m-xylenol, chloro-o-cresol, triclosan, norfenefrine, norepinephrine, hexyl-resorcinol, limonene, methylphenylcarbinyl acetate and p-tert-butyl-α-methylhydrocinnamic aldehyde.

Particularly preferred compounds in group (b) are alkyldimethylbenzyl ammonium chloride, octyltimethyl ammonium bromide, cetyltrimethylammonium bromide and dodecyltrimethylphosphonium bromide.

Particularly preferred compounds in group (c) are lauric, oleic, palmitic, ricinoleic and stearic acids, or the salts, amides, esters, ketones or aldehydes thereof.

It will be understood that certain of the aromatic or conjugated compounds may also be classed as fragrances.

The concentration of component (d) is from 0.01 to 80% w/w, preferably from 0.01 to 30%, more preferably from 0.01 to 10% w/w based on the non-ionic surfactant, component (b). The amount of component (d) is selected so that the bulk conductivity is

greater than the theoretical conductivity. In some cases, too great an amount of component (d) can result in the composition not fulfilling the conductivity requirement of the compositions of the invention.

It will be understood that mixtures of compounds may be used as component (d). In particular it has been found that the addition of an aromatic compound together with an ionic compound increases the charge to mass ratio of the formulations on spraying.

Oils or Solvents

One or more oils or solvents may be incorporated in the compositions of the invention in an amount of up to 80% w/w, preferably up to 40% w/w. Generally, the solvent will be water immiscible.

A wide range of oils or solvent materials may be used, although care should be exercised to ensure that the solvent does not adversely interact with any active components of the compositions of the invention, such as insecticides.

Examples of solvents that may be used in the compositions of the invention include:-

liquid n-paraffins, liquid isoparaffins, cycloalkanes, naphthene-containing solvents, white spirit, kerosene, ester solvents, silicone solvents or oils, fatty acids, dialkyl phthalates, C_5-C_{11} alcohols and fatty alcohols. Specific examples of these are as follows:-

liquid n-paraffins - Norpar^{RTM} 12, Norpar^{RTM} 13 and Norpar^{RTM} 15 (available from Exxon)

liquid isoparaffins - Isopar^{RTM} G, Isopar^{RTM} H, Isopar^{RTM} L, Isopar^{RTM} M and Isopar^{RTM} V (available from Exxon).

Naphthene-containing solvents - Exxsol D40, Exxsol D60, Exxsol D80, Exxsol D100, Exxsol D110,

Nappar 10, Solvesol 100, Solvesol 150, Solvesol 200 .
(available from Exxon)

Ester solvents - such as alkyl acetates, examples
being Exxate 1000, Exxate 1300 (available from Exxon),
and Coasol (available from Chemoxy International);

Silicone solvent oils - Dow Corning 244, 245, 344
and 345 fluids,

Fatty alcohols - octanol, dodecanol, lauryl
alcohol, myristyl alcohol, cetyl alcohol, stearyl
alcohol, cetostearyl alcohol, oleyl alcohol.

Preferred solvents are liquid hydrocarbon
solvents, n-paraffins, and iso-paraffins.

Although the solvent is preferably incorporated
at a level of from 1 to 20% w/w, more preferably the
concentration will be in the range of from 2 to 10%
w/w, most preferably about 5% w/w.

Insecticidal Compositions

In one preferred agent of the present invention
the compositions are insecticidal compositions which
contain from 0.001 to 5% w/w of an insecticidal
compound. A wide range of active ingredients may be
used of which pyrethroids, particularly synthetic
pyrethroids, chlorpyrifos, propoxur and diazinon are
preferred.

When synthetic pyrethroids such as lambda
cyhalothrin and bioresmethrin are used, generally they
will be incorporated in concentrations of about 0.02%
w/w or above.

Other synthetic pyrethroids such as cypermethrin,
tetramethrin, permethrin and bioallethrin, will
usually be incorporated to give a concentration of
about 0.2%-0.5% w/w, or above.

Chloropyrifos, propoxur and diazinion will generally be incorporated to give concentration in the range of 0.5-0.9% w/w.

Preferably, insecticidal compositions of the invention will include an insecticide which functions primarily to knock down an insect, together with a second insecticide which functions primarily as a kill agent. An example of such a combination is the use of permethrin as a kill agent in a combination with tetramethrin as a knock down agent.

Optional Ingredients

Various optional ingredients may be incorporated into the compositions of the present invention. For example, in order to maximise the effectiveness of the insecticidal activity of the compositions of the invention, synergists such as N-octylbicycloheptene dicarboximide and piperonyl butoxide may be included at a concentration of from 0.5 to 1.5% w/w, most preferably about 1.0% w/w, for use in conjunction with pyrethroid insecticides.

In addition, other ingredients including corrosion inhibitors, such as 1-hydroxyethyl-2-heptadecenyl imidazoline and/or sodium benzoate, preferably in a concentration from 0.01 to 0.5% w/w, preservatives and antioxidants, such as butylated hydroxytoluene, may be used as required. One or more fragrance components may also be included, according to the particular consumer requirements. It will be understood that certain fragrance components are components which may comprise component (d) of the compositions of the present invention and in this instance, such a component is not an optional ingredient.

Lewis Acid and Lewis Base Characteristics

In relation to the fourth embodiment of the invention an aerosol spray device and the electrically neutral composition contained therein have certain Lewis acid and Lewis base characteristics which assist in imparting a unipolar charge to the liquid.

When two substances are brought together and then separated, an electrical charge is transferred from one to the other. This can occur for solid-solid separations, for solid-liquid separations and for liquid-liquid separations. When one of the components becomes airborne, the electrical charge can remain on the substance for a significant length of time as there is no place to ground the charge. The ability of substances to transfer their charge can be related to the characteristic Lewis acid (γ^+) and Lewis base (γ^-) values for the substance. All substances have characteristic values and these can be calculated indirectly from their component surface energies.

These surface energies when combined with a London-van der Waals component (γ^{LW}) form what is known as the surface tension. This is easiest to measure at the interface between a drop of liquid on a solid substrate.

This equation used for these calculations comes from the approach used by Good and van Oss:

$$(1 + \cos\theta)\gamma_L = 2[\sqrt{(\gamma_s^{LW}\gamma_L^{LW})} + \sqrt{(\gamma_s^+ \gamma_L^-)} + \sqrt{(\gamma_s^+ \gamma_L^-)}]$$

Where θ is the contact angle that a drop of liquid makes with the surface.

γ_s is the energy component for the solid.

γ_L is the energy component for the liquid.

γ^{LW} Represents the London-van der Waals component.

γ^+ is the Lewis acid component (electron acceptor).

γ^- is the Lewis base component (electron donor).

Using three or more test liquids whose characteristics are known, it is possible to solve this equation for the three unknowns, γ_s^{LW}, γ_s^+ and γ_s^-. By using test solids whose characteristics are known, it is also possible to solve this equation to find the three unknown liquid surface energies. Thus it is possible to characterise a series of solids and liquids to form a series of γ^+ and γ^- values. In the case of solids this series matches that of the triboelectric series. Below is a non-exclusive list of solid substances that form part of this triboelectric series. The values are scaled such that water has a γ^- and γ^+ of 25 mJ m^{-2}. The top of the list tends to become positive, when separated from a substance at the bottom of the list, which would become negative.

Surface	γ^- (mJ m^{-2})

+ Glass	16
Acetal 900P NC-10	15
Celluloid	13.8
PMMA	12
Nylon	11.3
PVC	8.4
Polyester 2002-2	5
Polyethylene	0.1
Polypropylene	0.04
- PTFE	0

Liquids also have a value of γ^- and γ^+ that can be measured. When liquids contact a solid of known γ^- and γ^+ on aerosol spraying, and the γ^- of the liquid is greater than, or less than that of the solid by 2 mJ m^{-2}, preferably by 5 mJ m^{-2}, most preferably 15 mJ m^{-2}, or a γ^+ greater than, or less than that of the solid by 0.5 mJ m^{-2} preferably 1 mJ m^{-2}, most preferably 2 mJ m^{-2}, the liquid has a tendency to charge to +/- 1 x 10^{-4} C/kg. A common material from which inserts for aerosol actuators are made is Acetal 900P NC-10, which has a γ^- of 15 mJ m^{-2}.

Aerosol Spray Devices

The compositions of the present invention, when sprayed through conventional aerosol spray heads, form into droplets which are imparted with a unipolar charge of at least +/- 1 x 10^{-4} C/kg.

It is possible to impart even higher charges to the liquid droplets by choosing aspects of the aerosol device including the material, shape and dimensions of the actuator, the actuator insert, the valve and the dip tube and the characteristics of the liquid which is to be sprayed, so that the required level of charge

is generated as the liquid is dispersed as droplets.
A number of characteristics of the aerosol system
increase double layer charging and charge exchange
between the liquid formulation and the surface of the
aerosol system. Such increases are brought about by
factors which may increase the turbulence of the flow
through.the system, and increase the frequency and
velocity of contact between the liquid and the
internal surface of the container and valve and
actuator system.

By way of example, characteristics of the
actuator can be optimised to increase the charge
levels on the liquid sprayed from the container. A
smaller orifice in the actuator insert, of a size of
0.45mm or less, increases the charge levels of the
liquid sprayed through the actuator. The choice of
material for the actuator can also increase the charge
levels on the liquid sprayed from the device with
materials such as nylon, polyester, acetal, PVC and
polypropylene tending to increase the charge levels.
The geometry of the orifice in the insert can be
optimised to increase the charge levels on the liquid
as it is sprayed through the actuator. Inserts which
promote the mechanical break-up of the liquid give
better charging.

The actuator insert of the spray device may be
formed from a conducting, insulating, semi-conducting
or static-dissipative material.

The characteristics of the dip-tube can be
optimised to increase charge levels in the liquid
sprayed from the container. A narrow dip tube, of for
example about 1.27 mm internal diameter, increases the
charge levels on the liquid, and the dip tube material
can also be changed to increase charge.

Valve characteristics can be selected which increase the charge to mass ratio of the liquid product as it is sprayed from the container. A small tailpiece orifice in the housing, of about 0.65 mm,

5   increases the charge to mass ratio during spraying. A reduced number of holes in the stem, for example 2 x 0.50mm, also increases the charge during spray. The presence of a vapour phase tap helps to maximise the charge levels, a larger orifice vapour phase tap of,

10 for example, about 0.50 mm to 1.0 mm generally giving higher charge levels.

The liquid droplets sprayed from the aerosol spray device will generally have diameters in the range of from 5 to 100 micrometres, with a peak of

15 droplets of about 40 micrometres.

Preferably at least 90% by volume of the droplets of the disperse phase within the emulsion have an average diameter of less than 60μm, more preferably an average diameter in the range of from 20 to 40μm.

20 **Preparation**

The compositions of the present invention may be prepared by standard techniques which are well known in the art. For example, components (b) to (d) may be mixed together to form the solvent phase. This solvent phase is

25 then mixed with water to produce an emulsified concentrate which is then filled into cans and blended with the propellant. Alternatively, the concentrate and the propellant may be filled into the cans simultaneously.

Conductivity

30 The theoretical conductivity of an emulsion, σ, can be calculated from measurements of the actual conductivity of the external phase and the internal phase, according to the following equation:

$$\sigma = \sigma_c(1 + 3\varphi(\sigma_p - \sigma_c)/(\sigma_p + 2\sigma_c))$$

35   where σ = theoretical conductivity of the emulsion

σ_c = measured conductivity of the separated external phase

σ_p = measured conductivity of the separated internal phase

φ = volume fraction of the internal phase.

The bulk conductivity can be determined by experimentation. Component (d) of the compositions of the present invention serves to enhance the actual conductivity of the emulsion and thus the bulk conductivity of the emulsion is higher than the theoretical conductivity calculated according to the above formula. Preferably the difference between the theoretical conductivity of the emulsion of the emulsion is at least + 0.5 μS cm^{-1}, preferably at least $+4$ μS cm^{-1}, more preferably at least + 6 μS cm^{-1}. Component (d) in the compositions of the present invention thus improves the electron transfer through the emulsion with the charge being transferred from droplet to droplet through the emulsion at the interface between the disperse phase and the continuous phase.

The present invention will be further described with reference to the following non-limiting Examples.

Method for predicting the theoretical conductivity of an emulsion through the measurement of the conductivity of the individual phases:

1. Calibrate the conductivity cell by measuring a solution of known conductivity. The conductivity cell comprises a pair of platinum electrodes, held apart and attached to the inside of a glass tube of approximately 1 cm internal diameter.

2. Using the same cell, measure the conductivity of the bulk emulsion according to the invention, whilst ensuring that the emulsion is static and homogeneous prior to taking the measurement.

3. Determine whether the continuous phase of the emulsion is water or oil.

4. Separate the two phases of the emulsion by either gravimetric or centrifugal separation. Isolate the phases and measure the conductivity of each phase in the calibrated cell.

5. Use the equation given below to determine the theoretical conductivity of the bulk emulsion.

6. The difference between the theoretical conductivity and that obtained directly from the measurements is the contribution to the bulk conductivity due to the emulsion droplets.

$$\sigma = \sigma_c (1 + 3\varphi(\sigma_p - \sigma_c)/(\sigma_p + 2\sigma_e))$$

where
σ = theoretical conductivity of the emulsion

σ_c = measured conductivity of the separated external phase

σ_p = measured conductivity of the separated internal phase

φ = volume fraction of the internal phase.

Measurement of Electrostatic Charge

The charge to mass ratio of the compositions of Examples 4 to 50 was measured using a standard aerosol can with a valve insert made from polyoxymethylene

according to the design shown in accompanying Figure 1
in which

    Fig. 1a is a plan view;

    Fig. 1b is a sectional view; and

    Fig. 1c is a inverted plan view of the valve
    insert.

EXAMPLE 1 (Comparative)

An emulsion was prepared from the following
ingredients:

Ingredient	%
Ethoxylated (7EO) alcohol (C_{12}-C_{15})	0.24 w/v
Deionised water	47 v/v
Decane	55 v/v
Actual (measured) conductivity of the bulk emulsion	7.4 μS cm^{-1}
σ_c	16.6 μS cm^{-1}
σ_p	4.1 μS cm^{-1}
Assuming φ =	0.5
σ	8.2 μS cm^{-1}

Difference (conductivity due the emulsion
droplets) = 7.4 - 8.2 = -0.8 μS cm^{-1}.

This composition did not contain any component
(d) and as can be seen the bulk conductivity of the
emulsion is less than the theoretical value.

EXAMPLE 2

An emulsion was prepared from the following
ingredients:

Ingredient	%
Ethoxylated (7EO) alcohol (C_{12}-C_{15})	0.24 w/v
Sodium lauryl sulphate	3% w/w of the

(30% active)   non-ionic
surfactant

Deionised water	47 v/v
Decane	53 v/v
Actual (measured) conductivity of the bulk emulsion	22.3 $\mu S\ cm^{-1}$
σ_c	39.4 $\mu S\ cm^{-1}$
σ_p	4.0 $\mu S\ cm^{-1}$
Assuming φ =	0.5
σ	14.1 $\mu S\ cm^{-1}$

Difference(conductivity due the emulsion droplets) = 22.3 - 14.1 = 8.2 $\mu S\ cm^{-1}$.

EXAMPLE 3 (Comparative)

An emulsion was prepared from the following ingredients:

Ingredient	%
Ethoxylated (7EO)alcohol(C_{12}-C_{15})	0.24 w/v
Sodium lauryl sulphate (30% active)	6% w/w of the non-ionic surfactant
Deionised water	47 v/v
Decane	53 v/v
Actual (measured) conductivity of the bulk emulsion	23.3 $\mu S\ cm^{-1}$
σ_c	83.0 $\mu S\ cm^{-1}$
σ_p	9.0 $\mu S\ cm^{-1}$
Assuming φ =	0.5
σ	30.3 $\mu S\ cm^{-1}$

Difference(conductivity due the emulsion droplets) = 23.3 - 30.3 = -7.0 $\mu S\ cm^{-1}$.

This composition contains a large amount of component (d) and as can be seen the bulk conductivity of the emulsion is less than the theoretical value.

EXAMPLE 4

Ingredient	%
Ethoxylated (SEO) alcohol (C_{12-15}) incorporating benzalkonium chloride (50% active) at 2% w/w in surfactant	0.24% w/v
Deionised water	47% v/v
Butane 40	53% v/v

This formulation when made up as an aerosol and sprayed though the physical valve/actuator combination described above produced a mono-polar charge on the sprayed droplets of $+1.65 \times 10^{-4}$ C/Kg.

The same formulation was prepared substituting decane for butane in order that the conductivity could be measured.

Actual (measured) conductivity of the bulk emulsion	$15.7 \mu S\ cm^{-1}$
σ_c	$40.2 \mu S\ cm^{-1}$
σ_p	$3.3 \mu S\ cm^{-1}$
Assuming $\theta =$	0.5
σ	$13.7 \mu S\ cm^{-1}$

Difference (conductivity due to the emulsion droplets) = $15.7 - 13.7 = 2.0 \mu S\ cm^{-1}$

EXAMPLE 5

Formulation 1

Ingredient	% w/w
Solvent	5.0
Fragrance component	0.70
Butylated hydroxytoluene	0.013
Polyglyceryl oleate	0.30
Deionised Water	58.99
Butane 40	35

The solvent used and the fragrance component that can be used in the above formulation are illustrated in the following examples:

Example	Solvent	Fragrance Component	Charge/Mass (x10^4 C/kg)
5	Isopar E [TM]	diethyl-o-phthalate	-2.
6	Isopar E [TM]	styrallyl acetate	-2.
7	Isopar G [TM]	α-methyl ionone	-1.
8	Isopar G [TM]	vanillin	-1.6
9	heptane	Litsea Cybeba	-1?
10	pentane	Lilial	-?
11	Isopar E [TM]	phenylethyl alcohol	-1
12	Isopar L [TM]	dipropylene glycol	2

The Isopar E [TM], G and L range of solvents can be obtained from Exxon [TM].

The fragrance components used were obtained from Robertet Ltd.

EXAMPLE 13

Formulation 2

Ingredient	% w/w
Solvent	5.0
Aromatic component	0.70
Butylated hydroxytoluene	0.013
Polyglyceryl oleate	0.30
Deionised Water	58.99
Butane 40	35

The solvent used and the aromatic component can be used in the above formulation are illustrated in the following examples:

Example	Solvent	Aromatic Component	Charge/Mass $(\times 10^{Y4}$ C/kg)
13	Solvesol 150	Cleanox fragrance	-3.0
14	Isopar E	n-butyl benzoate	-2.5
15	Isopar L	isopropyl-4-hydroxybenzoate	-3.0
16	Isopar E	isobutyl acetophenone	+1.6
17	heptane	isopropyl acetophenone	+1.7
18	pentane	benzoic acid	+1.2
19	Isopar V	2-naphthol	-5.3
20	Isopar G	toluene	+1.9
21	Pentane	neopentyl benzene	-5.9
22	Isopar C	naphthalene	-5.4
23	Isopar G	fullerene C60/70	-4.5

EXAMPLE 24

Formulation 3

Ingredient	**%**
Ethoxylated (5EO) alcohol (C_{12-15}) incorporating sodium laureth sulphate (30% active) at 4% w/w in surfactant	0.24% w/v
Deionised water	47% v/v
Butane 40	53% v/v

This formulation, when made up as an aerosol and sprayed through the physical valve/actuator combination described above produced a mono-polar charge on the sprayed droplets of -1.1×10^{-4} C/kg.

The same formulation was prepared substituting decane for butane. The formulation had a γ^- of 26.2 mJ m^{-2}.

An acetal 900P NC-10 insert in the spray head had a γ^- of 15 mJ m^{-2}.

The difference between these Lewis base values = 26.2 - 15 = 11.2 mJ m^{-2}.

Ingredient	%w/w Example 25	%w/w Example 26	%w/w Example 27	%w/w Example 28
Bioallethrin	0.194	0.914	0.194	0.194
Bioresmethrin	0.036	0.036	0.036	0.036
BHT	0.02	0.02	0.02	0.02
Polyglycerol oleate	0.900	0.900	0.900	0.900
Oleic acid	0.09	0.180	0.045	0.023
Perfume	0.100	0.100	0.100	0.100
Norpar 13	7.500	7.500	7.500	7.500
Deionised water	51.16	51.07	51.2	51.227
H55	40.000	40.000	40.0	40.000
Charge/mass(x10^{-4} C/kg)	-0.75	-0.72	-0.6	-0.90

Ingredient	%w/w Example 29	%w/w Example 30	%w/w Example 31	%w/w Example 32
Teric 12A2	0.800	1.000	0.800	0.700
Oleic acid	0.400	0.400	0.400	0.400
Norpar 13	7.500	7.500	7.500	7.500
Deionised water	51.300	51.100	51.300	51.400
H55	40.000	40.000	40.000	40.000
Charge/mass(x10^{-4} C/kg)	-1.02	-0.68	-0.816	-0.816

Ingredient	%w/w Example 43	%w/w Example 44	%w/w Example 45	%w/w Example 46
Teric 12A2	0.700	0 0	0.700	0.700
Oleic acid (RTM)	0.500	0...0	0.400	0.400
Norpar 13	7.500	7...00	7.500	7.500
Deionised water	41.300	31.38	51.400	51.300
H55	-	-	-	-
H46	50.000	60.000	40.000	40.000
Charge/mass(x10^{-4} C/kg)	-1.39	-2.12	-0.71	-1.65

Ingredient	%w/w Example 47
Teric 17A2	0.85
Oleic acid (RTM)	0.35
Norpar 13	5.00
Deionised water	33.80
H46	60.000
Charge/mass(x10^{-4} C/kg)	-4.8

Ingredient	%w/w Example 48	%w/w Example 49
Norpar 13	5.00	5.00
Bioallethrin	0.25	0.25
Bioresmethrin	0.05	0.05
BHT	0.02	0.02
Deionised water	33.28	33.58
Teric 17A3	0.60	0.35
Crill 45	0.40	0.35
Pine Fragrance	0.10	0.10
Oleic acid	0.30	0.30
H46	60.00	60.00
Charge/mass (x10^{-4} C/kg)	-1.41	-1.34

Ingredient	%w/w Example 50
Bioallethrin	0.209
Bioresmethrin	0.039
BHT	0.005
Polyglycerol oleate (containing from 0.01 to 1% by weight of sodium or potassium oleate)	0.900
Perfume (UH)	0.100
Norpar 13	7.500
Deionised water	51.247
H55	40.000
Charge/mass (x10^{-4} C/kg)	-1.59

Ingredient	Comparative Example A	Comparative Example B	Comparative Example C
Teric 12A2	0. 4	1.000	1.000
Bioallethrin	0. 16	-	-
Bioresmethrin	0. 2	-	-
BHT	0.	-	-
Polyglycerol oleate	0.	-	-
Perfume $\beta 2M$	7.	7.500	7.500
Norpar 13	51	51.50	51.500
Deionised water	40.	40.000	40.000
H55 $\beta \pi 4$	0.40	0.35	40.000
Crill 45			
Charge/mass (x10^{-4} C/kg)	-0.35	+0.21	-0.017

EXAMPLE 62 to 68

The following Table provides details of compositions in which an aromatic dopant is added to the formulation of Example 51 but the purity of the surfactant was slightly different.

Example No	Aromatic Dopant	Conc^n	γ^- (mJ m^{-2})	γ^+ (mJ m^{-2})	Charge/ Mass (x 10^{-4} C/kg)
62	resorcinol	1.00*	25.0	2.5	-2.77
63	2-methoxy cinnam-aldehyde	1.00*	22.5	2.5	-2.50
64	arbutin	1.00*	45.0	2.5	-2.27
65	esculetin	1.00*	35.0	2.5	-2.07
66	trans-stilbene	1.00*	20.0	2.5	-1.86
67	4-isopro-poxy phenol	1.00*	20.0	2.5	-2.86
68	4-acetoxy-3-methoxy cinnam-aldehyde	0.22**	20.0	2.5	-2.53

* Concentration in columned MBQ Creston L (PGO) - Croda
** Concentration in final formulation

Ingredients and Availability

Oleic acid[1]	:	Technical (Croda Chemicals)
Lauric acid[1]	:	Reagent Grade (BDH)
Palmitic acid[1]	:	Reagent Grade (BDH)
Teric 17A3[2]	:	C_{17} alcohol with 3 moles of ethylene oxide (Orica)
Teric 17A2[2]	:	C_{17} alcohol with 2 moles of ethylene oxide (Orica)
Teric 12A2[2]	:	C_{12} alcohol with 2 moles of ethylene oxide (Orica)
Crill 45[2] (RTM)	:	Sorbitan trioleate (Orica)
Polyglycerol oleate[2]	:	Croda Chemicals
BHT[4]	:	Butylated hydroxytoluene (Orica)
Norpar 13[5] (RTM)	:	liquid n-paraffin (Exxon)
Bioallethrin[3]	:	93% w/w (Agrevo)
Bioresmethrin[3]	:	93% w/w (Agrevo)
H46[6]	:	16% w/w propane/butane blend (Boral)
H55[6]	:	26% w/w propane/butane blend (Boral)

1: Ionic Compound (d)   2: Non-ionic surfactant

3: Insecticide   4: Antioxidant

5: Solvent   6: Propellant

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CLAIMS:

1. An electrically neutral composition in the
form of a water-in-oil or an oil-in-water emulsion, in
5 which droplets of the emulsion on discharge from an
aerosol spray device are imparted with a unipolar
electrostatic charge, which composition comprises:
(a) at least one propellant in an amount of from 2
to 80% w/w;
10 (b) at least one non-ionic surfactant in an amount
of from 0.01 to 10% w/w;
(c) optionally one or more oils or solvents,
preferably aliphatic, linearly conjugated or aromatic,
within the oil phase in an amount of up to 80% w/w.
15 (d) at least one polar or ionic or aromatic or
linearly conjugated compound in an amount of from 0.01 to
80% w/w based on the non-ionic surfactant, but which is
such that the theoretical conductivity of the emulsion is
less than the bulk conductivity of the emulsion; and
20 (e) water.

2. A composition as claimed in claim 1 wherein
the difference between the theoretical conductivity of
the emulsion and the bulk conductivity of the emulsion is
25 at least + 0.5μS cm^{-1}.

3. A composition as claimed in claim 2 wherein
the difference between the theoretical conductivity of
the emulsion and the bulk conductivity of the emulsion is
30 at least + 4μS cm^{-1}.

4. A composition as claimed in claim 2 wherein
the difference between the theoretical conductivity of

the emulsion and the bulk conductivity of the emulsion is
at least + $6\mu S$ cm^{-1}.

5.   A composition as claimed in any one of the
5 preceding claims wherein at least 90% by volume of the
droplets of the disperse phase within the emulsion have
an average diameter of less than 60 μm.

6.   A composition as claimed in claim 5 wherein at
10 least 90% by volume of the droplets of the disperse phase
within the emulsion have an average diameter in the range
of from 20 to 40 μm.

7.   A composition as claimed in any one of the
15 preceding claims wherein at least one non-ionic
surfactant is selected from mono, di and tri sorbitan
esters, polyoxyethylene mono, di and tri sorbitan esters;
mono and polyglyceryl esters; alkoxylated alcohols;
alkoxylated amines; alkoxylated acids; amine oxides;
20 ethoxylated/proproxylated block copolymers; alkoxylated
alkanolamides; and alkoxylated alkyl phenols.

8.   A composition as claimed in claim 7 wherein
the non-ionic surfactant contains at least one alkyl, allyl
25 or substituted phenyl group containing at least one C_6 to C_{22}
carbon chain.

9.   A composition as claimed in any one of the
preceding claims wherein component (c) is optionally present
30 in an amount of up to 40% w/w.

10.   A composition as claimed in any one of the
preceding claims wherein component (d) is selected from

a)   alkali metal salts, alkaline earth metal salts, ammonium salts, amine salts or amino alcohol salts of one or more of the following compounds: alkyl sulphates, alkyl ether sulphates, alkylamidoether sulphates, alkylaryl-

5   polyether sulphates, monoglyceride sulphates, polyglyceride sulphates, alkyl sulphonates, alkylamine sulphonates, alkyl-aryl sulphonates, olefin sulphonates, paraffin sulphonates, alkyl sulpho-succinates, alkylether sulphosuccinates, alkylamide sulphosuccinates, alkyl sulphocinnamates, alkyl

10   sulphoacetates, alkyl phosphates, alkylether phosphates, acyl sarcosinates, acyl isothionates and N-acyl taurates;

b)   alkyl amidopropylbetaines, alkylamido-betaines, alkylamidosulphobetaines, alkylbetaines, aminimides, quaternary ammonium compounds and quaternary phosphonium

15   compounds;

c)   carboxylic acids, carboxylic acid salts, esters, ketones, aldehydes, amides or amines of carboxylic acids containing from 6 to 30 carbon atoms;

d)   diethyl orthophthalate, methylphenylcarbinyl

20   acetate, α-methyl ionone, 4-hydroxy 3-methoxy-benzaldehyde, phenylethyl alcohol, dipropylene glycol, styryl acetate, n-butyl benzoate, isopropyl 4-hydroxybenzoate, isobutyl acetophenone, isopropyl acetophenone, nicotinic acid, benzoic acid, 2-napthol, neopentyl benzene, naphthalene,

25   toluene, fullerene, tannic acid, t-butylacetophenone, isopropylcinnamte, resorcinol, 4-methoxycinnamalde-hyde, arbutin, 4-acetoxy-3-methoxycinnamaldehyde, 4-isopropylphenol, trans-stilbene, esculetin, p-chloro-m-xylenol, chloro-o-cresol, triclosan, norfenefrine,

30   norepinephrine, hexyl-resorcinol, limonene, methylphenylcarbinyl acetate and p-tert-butyl-α^--methylhydrocinnamic aldehyde.

11.   A composition as claimed in any one of the
preceding claims wherein component (d) is present in the
composition in an amount of from 0.01 to 30% w/w
based on the weight of component (b).

5

12.   A composition as claimed in claim 11 wherein
component (d) is present in the composition in an amount
of from 0.01 to 10% w/w based on the weight of the
composition.

10

13.   A composition as claimed in any one of the
preceding claims wherein the droplets formed on discharge
from an aerosol spray device have a charge to mass ratio
of at least +/- 1 x 10^{-4} C/kg, preferably at least +/- 2

15   x 10^{-4} C/kg.

14.   A composition as claimed in any one of the
preceding claims which is an insecticidal composition which
includes one or more insecticides therein in an amount of

20   from 0.001 to 5% w/w.

15.   A method of enhancing the unipolar charge
which is imparted to droplets of an emulsion on discharge
from an aerosol spray device in which the droplets are

25   formed from an oil-in-water or a water-in-oil emulsion
composition which comprises:
        (a)   at least one propellant in an amount of from 2 to
80% w/w;
        (b)   at least one non-ionic surfactant in an amount of

30   from 0.01 to 10% w/w;
        (c)   optionally one or more oils or solvents,
preferably aliphatic, linearly conjugated or aromatic,
within the oil phase in an amount of up to 80% w/w;

(d) at least one polar or ionic or aromatic or linearly conjugated compound in an amount of from 0.1 to 80% w/w based on the non-ionic surfactant, but which is such that the theoretical conductivity of the emulsion is less
5 than the bulk conductivity of the emulsion; and
(e) water.

16. A method as claimed in claim 15 wherein component (c) is optionally present in an amount of up to 40% w/w.
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17. The use of a non-ionic surfactant and at least one polar or ionic or aromatic or conjugated compound in an amount of from 0.01 to 80% w/w based on the non-ionic surfactant to enhance the electrostatic charge imparted to
15 droplets of a composition in the form of a water-in-oil or an oil-in-water emulsion on discharge from an aerosol spray device, which composition includes:
(a) at least one propellant in an amount of from 2 to 80% w/w;
20 (b) optionally one or more oils or solvents, preferably aliphatic, linearly conjugated or aromatic, within the oil phase in an amount of up to 80% w/w; and
(c) water;
and the amount of the polar or ionic or aromatic or
25 conjugated compound being such that the theoretical conductivity of the emulsion is less than the bulk conductivity of the emulsion.

18. The use as claimed in claim 17 wherein component
30 (b) is optionally present in an amount of up to 40% w/w.

19.   A composition as claimed in claim 1 substantially
as hereinbefore described with reference to any one of the
Examples.

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